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ABSTRACT

Football injuries which resulted in permanent spinal cord injury are reported in this survey, part of a concerted effort by individuals and research organizations to reduce the steady increase of football head and neck injuries since the late 1950s. In addition to the reporting of injuries, this document describes steps taken to eliminate the occurrence of these types of injuries. A discussion is presented of the situations in which severe injuries have been sustained by players, and recommendations are given for reducing such injuries. Case studies are presented of catastrophic injuries resulting in quadriplegia in 11 high school football players and one college player. (JD)

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ANNUAL SURVEY OF
CATASTROPHIC FOOTBALL INJURIES
1977 - 1983

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Catastrophic Football Injuries

Introduction

In 1977 the National Collegiate Athletic Association initiated funding for the First Annual Survey of Catastrophic Football Injuries. Frederick O. Mueller, Ph.D., and Carl S. Blyth, Ph.D., both professors in the Department of Physical Education at the University of North Carolina at Chapel Hill were selected to conduct the research.

The Annual Survey of Catastrophic Football Injuries is part of a concerted effort put forth by many individuals and research organizations to reduce the steady increase of football head and neck injuries since the late 1950's. The primary purpose of the research is to make the game of football a safer sports activity.

Data Collection

For the purpose of this research catastrophic injuries were defined as football injuries which resulted in permanent spinal cord injury. Injuries which resulted in death were not included with this report. Data were compiled with the assistance of high school and college coaches, athletic directors, school administrators, physicians, athletic trainers, executive officers of state and national athletic organizations, sporting goods dealers and manufacturers' representatives, a national newspaper clipping service, and professional associates of the researchers. The research was funded by a grant provided by the National Collegiate Athletic Association.

Upon receiving information concerning a possible catastrophic football injury, contact by telephone, personal letter, and questionnaire was made with the injured player's coach or athletic director. The questionnaire provided background data on the athlete (age, height, weight, experience, previous injury, etc.), accident information, immediate and post-accident treatment, and equipment

data. After reviewing the 1977 data, a telephone follow-up, which provided valuable information, was added to the study protocol to ascertain the status and prognosis of the injured player.

Background

An early investigation into the head and neck problem was conducted by Schneider. (1) He reported 30 permanent cervical spinal cord injuries in high school and college football during the period from 1959-1963. A later study by Torg indicated a total of 95 permanent cervical spinal cord injuries in high school and college football from 1971-1975. (3) Torg has continued his research and his data show a decline in permanent cervical cord injuries in high school and college from 32 cases in 1976 to 11 cases in 1978. A study published in 1976 reported the incidence of neck injuries based on roentgenographic evidence was as high as 32% in a sample of 104 high school students and 75 college freshmen in Iowa. (2)

In order to help alleviate this problem the National Collegiate Athletic Association and the National Federation of State High School Associations implemented rule changes in 1976 to prohibit using the head as the initial contact point when blocking and tackling, and the American Football Coaches Association Ethics Committee went on record opposing this type of blocking and tackling. In addition, the establishment of a football helmet standard by the National Operating Committee on Standards for Athletic Equipment (NOCSAE) was accepted by the National Collegiate Athletic Association for the 1978 football season and by the National Federation of State High School Associations for the 1980 football season. Many colleges and high schools had adopted NOCSAE approved helmets before the deadline dates of 1978 and 1980. Emphasis on complete physical examinations and improved physical conditioning programs has also been recommended to mitigate the injury issue.

Summary

1. During the 1983 football season there was a total of twelve permanent cervical cord injuries. Eleven of the injuries occurred in high school and one in college. (Table I)
2. The incidence of catastrophic injuries is very low on a 100,000 player exposure basis. For the approximately 1,575,000 participants in 1983, the number of permanent paralysis injuries was .76 participants per 100,000 players.
3. The incidence of permanent paralysis injuries in high school football was .84 participants per 100,000 players and the incidence at the college level was 1.33 participants per 100,000 players. (Table II)
4. A majority of catastrophic injuries occur in games. During the 1983 season ten catastrophic injuries occurred in games and two in practice.
5. Tackling and blocking have been associated with the majority of catastrophic football injuries. In 1983 eight of the injuries were caused by tackling, three while being tackled, and one player injured while hitting a tackling machine in practice.
6. As indicated in Table III a majority of the catastrophic injuries occur while playing defensive football. In 1983, nine of the eleven injured players were on defense and three were on offense. Three of the defensive players were tackling on kick-offs and one was tackling while covering a punt. (Tables III and V).

Discussion

For the past seven years there have been a total of eighty football players with permanent cervical cord injuries. Sixty-four of these injuries have been to high school players and twelve to college players. This data indicate a reduction in the number of permanent cervical cord injuries when compared to data published in the late 1950's and early 1970's but there has not been any reduction since 1977. There is still an average of 11.4 permanent cervical cord injuries per year.

It must also be noted that these numbers do not include players with fractured cervical vertebrae who were lucky and did not acquire permanent injury.

The latest participation figures show 1,300,000 players participating in junior and senior high school football and 75,000 in college football. Table II illustrates the incidence of permanent cervical cord injuries for both high school and college participants. The incidence rates per 100,000 participants are low in both high school and college. In looking at the incidence rates for the past seven years, the high school incidence is .70 per 100,000 participants and the college incidence is 2.29 per 100,000 participants. This difference between the high school and college incidence rates is significant at the .001 level, which means that this difference will show 99 out of 100 times.

As indicated in past reports a majority of the permanent cervical cord injuries are taking place in games. In 1983 ten of the twelve injuries took place in games. One of the practice injuries happened while using a mechanical spring loaded tackling machine that has been taken off the market for being unsafe.

Table III indicates that when comparing permanent cervical cord injuries to offensive and defensive players, it is safer playing offensive football. During the seven year period from 1977-1983, fifty-nine of the eighty players injured were playing defense. A majority of the defensive players were tackling when injured. In 1983 eight of the twelve players were tackling and five of these were tackling with their heads down (position of flexion). Most coaches have indicated that their players have been taught to tackle with the head up, but for some reason the players are lowering their heads before making contact.

Past reports have revealed that defensive backs were injured at a higher rate than other positions, but the 1983 report has only one defensive back being injured. The 1983 report does show that three injured players were tackling on kick-offs and one was tackling while covering a punt.

Recommendations

As mentioned in the 1982 report there has been a reduction of permanent cervical cord injuries when compared to earlier data. It must be emphasized that this reduction is only the first step and that there must be greater efforts to further reduce these numbers. Following are several suggestions for reducing catastrophic football injuries:

1. Rule changes initiated for the 1976 football season which eliminated the head as a primary and initial contact area for blocking and tackling is of utmost importance. Coaches should drill the players in the proper execution of the fundamentals of football, particularly blocking and tackling. Shoulder block and tackle - keep the head out of football.
2. Athletes must be given proper conditioning exercises which will strengthen their necks in order to be able to hold their heads firmly erect while making contact.
3. Coaches and officials should discourage the players from using their heads as battering rams when blocking and tackling. The rules prohibiting spearing should be enforced in practice and games. The players should be taught to respect the helmet as a protective device and that the helmet should not be used as a weapon.
4. All coaches, physicians and trainers should take special care to see that the players' equipment is properly fitted, particularly the helmet.
5. It is important, whenever possible, for a physician to be on the field of play during game and practice. When this is not possible, arrangements must be made in advance to obtain a physician's immediate services when emergencies arise. Each institution should have a team trainer who is a regular member of the institution's staff and who is qualified in treating and preventing injuries.
6. Coaches must be prepared for a possible catastrophic head or neck injury. Everyone involved must know what to do. Being prepared and knowing what

to do may be the difference that prevents permanent disability.

Football catastrophic injuries may never be totally eliminated, but continued research has resulted in rule changes, equipment standards and changes in teaching the fundamental techniques of the game. These changes were the result of a united effort by coaches, administrators, researchers, equipment manufacturers, physicians, trainers and players. Research based on reliable data is essential if progress is to be made. Research provides data that indicate the problems and reveal the adequacy of preventive measures.

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Catastrophic Injuries 1983 - Case Studies

High School

A 14 year old high school freshman football player fractured his 5th cervical vertebra in a game October 6, 1983. He was on the kick off team and was tackling the ball carrier. Head position is not known at this time. The accident happened in the third quarter of a game. The player is a quadriplegic.

A 16 year old high school senior received a contusion to the 5th cervical vertebra when he was tackled in a game. He was first hit by two tacklers and then hit by two more tacklers. At the present time he is a quadriplegic. The player was born with congenital cervical spinal stenosis, which one physician stated would increase his chances for this type of injury. This condition was unknown when he started playing football. The injury happened in November 1983.

On September 10, 1983, a 16 year old high school junior was making a tackle on a kick off. As contact was made he lowered his head and his head made contact with the ball carrier's thigh. He fractured his 5th cervical vertebra and is now a quadriplegic.

On November 18, 1983, a 17 year old high school senior was making a tackle on the opening kick off of a state championship game. He and the ball carrier hit head on, helmet to helmet. The tackler received a fracture to the 4th and 5th cervical vertebra and is a quadriplegic.

A 17 year old high school football player was participating in a practice contact drill on September 5, 1983, and fractured his 5th cervical vertebra. He was tackling and as he made contact his head was down and struck the thigh of the other player. The player is a quadriplegic.

While covering a punt a 15 year old high school football player fractured his 5th cervical vertebra and was paralyzed. He tackled the ball carrier with his head down and his head struck the thigh of the opposing player. He is now a quadriplegic. The accident took place in a game.

In a high school football game on November 10, 1983, a defensive tackle was preparing to make a tackle. The 17 year old tackle slipped right before making contact and lowered his head. He suffered a fractured cervical vertebra and is a quadriplegic.

A 16 year old high school football player was injured in practice while hitting a mechanical tackling dummy. He fractured his 5th cervical vertebra and is now a quadriplegic. The tackling dummy has been taken off the market for many years due to being unsafe.

A 15 year old high school sophomore received a fractured 5th cervical vertebra in a football game. He slipped on wet turf and struck the ball carrier with his head down while tackling. The player is now a quadriplegic.

A high school wide receiver was making a tackle in a game after an interception. At the last moment he dropped his head and the top of his head made contact with the ball carrier's hip. He fractured his 2nd cervical vertebra. The 17 year old player is now a quadriplegic.

A high school quarterback fractured his 5th cervical vertebra in a game while being tackled. He was rolling out to pass and was hit by two opposing players. He was piled on after the tackle and his head was in a bad position. At the present time the player is a quadriplegic.

College

A 19 year old college sophomore fractured his cervical vertebra while being tackled in a game on September 24, 1983. He was running the ball around end and was hit hard from the rear as he fell to the ground. He is now a quadriplegic.

TABLE I
PERMANENT CERVICAL CORD INJURIES 1977 - 1983 *

YEAR	SANDLOT	PRO AND SEMI-PRO	HIGH SCHOOL	COLLEGE	TOTAL
1977	0	0	10	2	12
1978	0	1	12	0	13
1979	0	0	8	3	11
1980	0	0	10	2	12
1981	1	0	6	2	9
1982	1	1	7	2	11
1983	0	0	11	1	12
TOTALS	2	2	64	12	80

*Figures are updated annually due to new cases investigated after publication.

TABLE II
INCIDENCE PER 100,000 PARTICIPANTS *

YEAR	HIGH SCHOOL	COLLEGE
1977	.77	2.67
1978	.92	0.00
1979	.62	4.00
1980	.77	2.67
1981	.46	2.67
1982	.54	2.67
1983	.84	1.33

*Based on 1,300,000 High School Players and 75,000 College Players

TABLE III
OFFENSIVE vs. DEFENSIVE FOOTBALL

YEAR	OFFENSE	DEFENSE	UNKNOWN	TOTAL
1977	1	7	4	12
1978	1	10	2	13
1979	1	8	2	11
1980	1	11	0	12
1981	1	6	2	9
1982	3	8	0	11
1983	3	9	0	12
TOTALS	11	59	10	80

TABLE IV
CATASTROPHIC INJURIES 1983: TYPE OF ACTIVITY ENGAGED IN

TYPE OF ACTIVITY	NUMBER
Tackling (Head position unknown)	2
Tackling (Head down)	5
Tackling (Head up)	1
Being Tackled	3
Hitting Tackling Machine	1
TOTAL	12

TABLE V
CATASTROPHIC INJURIES 1983: POSITION PLAYED

POSITION	SANDLOT	PRO	HIGH SCHOOL	COLLEGE	TOTAL
Defensive Back	0	0	1	0	1
Running Back	0	0	1	1	2
Offensive End (Punt)	0	0	1	0	1
Flanker (Tackling)	0	0	1	0	1
Tackling on Kick Off	0	0	3	0	3
Quarterback	0	0	1	0	1
Defensive Lineman	0	0	3	0	3
TOTALS	0	0	11	1	12